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APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
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08/519,420 08/25/95 FUKUNAGA

T 756-1398

EXAMINER
PADGETT, M

AIM1/0903

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ART UNIT PAPER NUMBER

1112
DATE MAILED:

09/03/96

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

OFFICE ACTION SUMMARY

☒ Responsive to communication(s) filed on 5/28/96

☒ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 D.C. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire _____ month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-4, 6-15 & 17-22 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-4, 6-15 & 17-22 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of Reference Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

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(15) Claim 10 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 10, as amended is self contradictory, since the irradiating step is claimed to effect the amorphous silicon film, hence is not being preformed on the crystalline film during its heat treatment, which comes after. What is actually intended can only be guessed at. If applicants are attempting a dependent claim that combines the two steps, that does not properly limit the independent claim as it is now phrased to have a required sequence. If applicants' intent is to continue laser irradiation after crystallization and during the heat treatment, different wording is needed.

(16) The disclosure is objected to because of the following informalities: inconsistencies were noted between discussion of Fig. 8 on p. 12 and the actual would used to label various portions of the table in Fig. 8.

Appropriate correction is required.

(17) In the paragraph bridging pages 6-7 of their response, applicant state that "claims 1, 2, 6, 11, 21 and 22 all recite ... using a catalytic element ... heating the

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crystallized .. to decrease defects, particularly.. spin density and dangling bonds...". Since only claims 1 and 2 recite any defects effected, then only the specific ones, applicants' statement could be taken that any heating after laser treatment will inherently produce the claimed effects, or alternately, that they are mistaken. Furthermore, claims 1 and 2 have been explicitly amended to REMOVE any claims to use of metals or catalyst, hence applicants understanding of what they have claimed appears to be in error.

(18.) The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

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The non-statutory double patenting rejection, whether of the obviousness-type or non-obviousness-type, is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent. *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); and *In re Goodman*, 29 USPQ2d 2010 (Fed. Cir. 1993).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(b) and (c) may be used to overcome an actual or provisional rejection based on a non-statutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.78(d).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

(19) Claims 1-4 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Takemura.

See col. 5, lines 42-68 for various alternative laser irradiation and thermal annealing techniques, particularly thermal annealing either or both, before and after laser treatment; See col. 7, lines 11-52 for implanting of Si₁^{substrates}, the laser recrystallizing and col. 8, lines 14-40 in example 2 for laser treating amorphous silicon to improve and promote the crystallinity, with subsequent annealing at 350°C for two hours in H₂. Note teachings on reducing defects and dangling bonds. Notice is taken when dangling bonds are reduced in number, a spin

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density corresponding thereto will inherently, like wise be reduced. Also, particular note claims 1-2, 4-5 and 7-8.

(20.) Claims 1-4 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 1-2, 4-5, 7-8 of U.S. Patent No. 5,403,762. Although the conflicting claims are not identical, they are not patentably distinct from each other because it would have been obvious to one of ordinary skill in the art to use one of the most commonly used amorphous semiconductors, α -Si, in Takemura's claimed process as the generic claim is suggestive of success and the material typical or conventional.

(21.) Claims 1-4 are rejected under 35 U.S.C. 102(e) as being clearly anticipate by Zhang et al. (937).

See Abstract; Fig. 1 (etc); col. 4, lines 1-32 and 59- col. 5, line 20 and 58-col. 6, line 52, noting both thermal and radiation treatment appear to be taught to convert the amorphous area entirely to crystalline. Particularly see col. 9, lines 15-45 for α -Si with Ni to promote crystallization, then lines 46-59 where laser light appears to be taught for use in conjunction with the thermal treatment to cause crystalline^{ization} and the effect on dangling bonds is mentionly, and lines 60-67 where the next step includes heating of the entire substrate from 300°-550°C, hence

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will inherently fulfill the claimed thermal post-treatment step. Furthermore, in the making of the same device, after ion implanting (col. 10, lines 20-41) laser annealing is preformed again (col. 10, line 42-67) and then it is taught that "it is important that dangling bonds caused in the process of light annealing ... are neutralized by heating them at a temperature of from 250° to 400°C in the atmosphere of hydrogen in a later process" (col. 11, lines 12-16), hence doubly reading on these claims.

② Claims 1-4 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Fan et al.

As previously pointed out, Fan et al. teaches a catalyzed laser beam amorphous to crystalline semiconductor - solid phase (i.e. lower temperature) conversion process, discussing α -Si on col. 2, line 50 - col. 3, line 30 and particularly on col. 11, line 50 - col. 12, line 25. In col. 11, note the teaching of a background heating temperature and the use of a pulsed laser, which would result in repeated laser treatment, than heat treatment steps corresponding to applicants' claims, since Fan et al's process is carried out in an Ar/H₂ atmosphere (col. 5, lines 33-40), which means that the dangling bonds would be inherently

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being neutralized by the subsequent or continuous background heating that is still present after the laser irradiation has passed. Note teachings of using a metal layer of Cu, Ag, Sn, Au or other metal (col. 12, lines 1-2), next to the amorphous Si layer.

(23) Claims 1-4 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Celler.

See abstract; col. 1, lines 23-40 and 55- col. 2, line 30 for lasers to ~~recrystallize and subsequent heating~~, as well as impurities, such as Cu, Ni, Fe and Au; then amorphous semi-conductors, such as ~~Si~~ ^{Si} col. 3, lines 26-34 and lines 46-col. 4, line 68, esp. lines 4-

14, 46 and 56-59; col. 5, lines 18-32 and col. 6, lines 10-19.

(24) Claims 6-15 and 17-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fan et al. or Celler as applied to claims 1-4 above, and further in view of Hemple et al. or Hayzelden et al. and in view of Pressley.

While Fan et al. does not teach use of metal elements in an interstitial position in α -Si films, either Hayzelder et al.

(abstract; paragraphs 2-4) or Hampel et al. (Abstract, page 921)

teach α -Si with either ion implanted or co-sputtered Ni, respectively, both of which show the same phenomenon as taught in either Fan et al. or Celler of a lower temperature/quicker annealing with the presence of a metal (Ni) as a catalyst, hence it would have been obvious to one of ordinary skill that intentional introduction of metal catalyst into α -Si films would

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produce the same effects in the above^{discussed} Fan et al. or Cellars as their use of either an upper or lower very thin layer or as an impurity of unspecified source, especially as the presence of the conductive metal is all that is seen to be needed. Note Hempel's concentration is given in different units (at%) which examiner can not convert with the information available and Hayzelden et al. only give the peak concentration, hence the average for the layer would be considerably lower, probably in applicants' range, however, it would have been obvious to one of ordinary skill to optimize concentration for most advantageous annealing. Note all references teach the claimed temperatures.

Neither of the above sets of rejections teach application of the metal materials via a solution, however, applying "dopant" materials or just a layer of metal via solution is a conventional practice, and as shown in col. 3, lines 3-11 of Pressley, may be considered equivalent to vapor deposition or ion implantation when further irradiation treatment is contemplated, hence it would have been obvious to apply metals as taught by Fan et al. for annealing purposes via solutions as it puts the element in a layer in contact with the layer to be treatment and a site as claimed with the expectation of equivalent results.

Pressley is equally applicable to Cellar, as both references

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intent is to getter defects by metallic elemental impurities, hence it would have been obvious to use Pressleys mode of control via purposeful introduces of impurities in Cellar mode of treatment^{ing} defects, including introduction via solution.

It is noted that solutions as discussed in Pressely are commonly aqueous, hence use of water or polar solvent in such depositions would have conventional.

(25) Imahashi et al. and Moddel et al. were cited as of Interest for repetitive irradiation/heating technique. Toge show the criticality of a metal layers thickness, ie masking effects. Liu et al, and Fanash et al. may be considered equivalent to Fan et al. as previously applied, except for teaching an alternate non-laser irradiation source.

The references of Pankove et al. and Zhang et al. (291) are cited as of interest to laser annealing and thermal annealing techniques for α -Si, as is Takayama et al. with additional catalyst teachings.

(26) Applicant's arguments with respect to claim 1-4, 6-15, and 17-22 but are moot in view of the new ground(s) of rejection.

(27) Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is

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reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

(22) Any inquiry concerning this communication should be directed to M. Padgett at telephone number (703) 308-2336.
FAX number (703) 305-3599
-3600



M. Padgett:rg
August 28, 1996

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